

Methodology for Generating a Low Cost Tourist Mapping applied to Small Brazilian Municipalities

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Abstract. This paper presents a type of project developed during the course of cartographic engineer of the Federal University of Pernambuco - Brazil, in a campaign extension the academic communities. The purpose is providing inexpensive solutions of mapping to a community and municipalities. The work shows a tourist map generated with GPS surveying and the conveying of tourist spatial data by means maps. For community the message with this works is encourage the use of map like an essential mechanism to promote the region's tourist attractions. Consequently increasing the interest and encouraging the tourist in their choice of visiting the location and using the services linked to the activity. The methodology applied is very simple: firstly, cartographic data collection; choice of mapping method based on existing data; the next step is an analysis is to prepare the spatial data; planning field survey, data classification of existing tourist attraction in the municipality according to the standards of Embratur (Tourism National Ministry); choice of graphic variables to be used to the map graphical print and web publishing; choice of scale printing, choice the visualization process and finally, test the graphic variables to impression version and display monitor. One of the main difficulties in this kind of project in Brazil it is the lack of base maps. It is necessary to construction all de cartographic data or using the base maps with unknown quality or old maps with more than forty years.

Keywords: Tourist Map, Cartographic Solutions, Low Cost.

1. Introduction

The main motivation for developing the tourist design map in Gravatá, it was the lack of a tourist map in this region, considered one of the most important tourist cities in the state of Pernambuco, in addition, on a previous study it showed an urban sprawl and population increase in this region influenced by tourism. In the same context, there is yet another phenomenon of the real estate demand of horizontal condominiums, seen in these facts resulted in a real estate socio-economic dynamic and services faced to tourism: hotel industry, artisanal trade, tourist agency, etc. This project was done during an academic extension course of the thematic cartography at Pernambuco Federal University were public administration of this municipality agree to support only transportation and hospitality the students. All efforts of this project were performed to convince the public administration that a tourist map is a powerful tool for sustainability tourist of the region. To do this in academic project without the financial resources and without map base (topography map) of the city to was a great challenge for students. In this case, it had to be developed a methodology for very low cost with extremely short period (two months) and that could meet the purpose of the municipal public administration and surely the end users, tourists.

2. Study Area Characterization

The municipality of Pernambuco, Gravatá, in Brazil, has an approximate area of 505 km² and has a growing population, a 10-year period (2000 to 2010) the population increased 14%. From these 14%, about 90% are in urban areas according to data from the 2010 IBGE Census (2011). One of its main economic activities is tourism, a major contributor to the city's economic growth and the furniture market, a town's major attraction. Located approximately 85 km from the state's capital, with weather that allows an average annual temperature of 19°C, it attracts regional tourists, for its pleasant climate and considered below Northeastern annual average of 28 °C. The proximity to the capital also makes Gravatá one of the Northeast cities' with the fastest tourism growth. The average population of this municipality during periods of peak season (school holiday months) usually doubles. Currently there are more than 25 lodging establishments operating in the municipality. These establishments have up to 100% occupancy when the city hosts its festivities during high season. Besides the hotel enterprises, Gravatá is the third city in the state to own private homes unoccupied for occasional use with 7488 households classified in this situation (IBGE, 2011). These properties are home to visitors on weekends, holidays and times of festivities, functioning as temporary residence for those who have Gravatá as their destination. These establishments have a great importance to the city, since that supports the hospitality industry that has full occupancy during periods of peak season (period of increased flow of tourists).

Tourism, besides being one of the economic activities of greater profitability and success, in Gravatá ended up subsidizing the growth of other sectors such as retail market, furniture industry and especially the real estate industry. According to IBGE (2011), the Service Tax (ISS) collection has nearly doubled in 10 years. With the considerable increase in the people flow and hence the city's revenue, it is suitable to improve tourist information quality of Gravatá, and this study aimed to contribute to the development of a tool that would provide more comfort and practicality its visitors. According to Fernandes and Menezes (2003), if the tourist information is geographical, it can be worked in two different ways, either for tourism planning, to provide input for tourism development in the city and for the visiting tourists orientation.

3. Tourism and Cartography

The cartography follows the entire tourism planning process from the availability of the study and the potential of a locality diagnostic to the practice of tourism itself, like the tourist map. In the initial cartographic planning phase, according to Oliveira (2005) accounts for the base maps preparation, either by compiling existing maps and charts, or by working with primary sources to generate new maps. At the stage of communication resources and approach the tourists, the tourist map is a media that brings development and promotes tourism and makes it attractive.

According to Beni (2003), the tourist map has the goal to provide basic information for the development and promotion of tourism. Among so many thematic choices of maps that can help the tourist, such as road, transport maps, city maps, etc., the tourist map is one that should cover for the tourist resources of their interest in the locality and will assist them with their travel needs, such as location of roads, hotels, cultural attractions, parks, businesses, local delivery service, infrastructure support and access, etc.

The promotion of tourism, according Petrocchi (2004), is part of the locality strategic planning. It is a tool that enables to expand the visitor's interest and encourage their

decision to travel. The tourist map is then a cartographic product that may help promote tourism.

Martinelli (2003) discusses the qualitative, quantitative and ordered aspects regarding the map production according to the context of the theme, in other words, adapting it to its applicability. In the case of a city's tourist map, the proportionality between the tangible, physical location, and the abstract and the graph location should be appropriate in order to promote understanding, interpretation and the interest of the tourist attraction.

In this sense, the map is no longer a mere handout of space, the "where", and becomes an agent facilitator of cognition.

Cognition is the act or process of knowing. It includes attention, perception, memory, thought, imagination, judgment and speech (Nogueira, 2009). This is where cartography comes in the business of communication, enabling the map user not only information but also to interact with the theme.

Tourist mapping provides the cartographer with both serious challenges and exciting opportunities. A map acquired at the tourist site ... or by some trinket purchased at the gift shop that will prompt a mental map. Probably the most important "product" is the mental (cognitive) map that has been developed. (McCleary, 2009)

The Tourist Cartography refers is within the Thematic Cartography, branch of cartography who cares to submit maps to the general public, ordinary users and not necessarily professionals with technical knowledge for reading and interpretation of graphical information. Consequently, the tourist maps' graphics resources must offer an overview of the area visited, so that the user understand and interact with content represented on the map even before its visitation. In this aspect, it is inevitable the field survey and contact with tourists who are on site, as well as those who promote themselves with tourism such as traders, travel agents, hoteliers, public officials or managers of the locality. (Fernandes & Menezes, 2008).

Therefore, the design a tourist map for the city is vital, especially if your main objective is to evoke in the minds of viewers an environmental image appropriate to the map's purpose. There are a great many graphical ways you could represent tourist geographical data, concepts, and relationships. For students, this project trying to show that the preparation of a map is not a mechanical process like taking a photo. Instead, it involves purposeful assembling, processing, and abstracting diverse data and then symbolically displaying them as a meaningful, functional portrayal. Map design is not a simple task, since there are almost unlimited options organizing the visual character of the display, especially when it has two options of visualize: electronic map and printed map. The other place, it is necessary create solutions for all steps of the thematic cartography project because most municipalities in Brazil have no base maps suitable for the generation of a tourist map. This type of situation forces students to find economic solutions and technical. For that reason, it is expected that in the end of this project, tourism incentive in the city will increase, but also with higher growth and economic sustainability, promoting the tourist facilities for proper planning of its activities in accordance with its time availability and still offer an overview and location of all there is touristic in the city and also students leave with a good bag of applied practical experience the reality of this region.

4. Methodology

4.1. Cartographic data collection

Despite the efforts of bibliographic research and survey of existing cartographic documents, were found poor quality spatial data: raster topographic maps at very small scales 1:100,000 from 1999, vector map with 1:10,000 scales without reference geodetic and coordinates systems, satellite imagery LANDSAT from 2002. In this case, it is not easy to make a tourist map, mainly if not has money also.

4.2. Mapping method based on existing data

The unique choice mapping method on existing poor quality spatial data is working with low precision map. The vector map with 1:10,000 scales was georeferenced coordinates collected with GPS navigation coordinates with 15m of the precision, thereafter, from Landsat satellite images, the main streets were collected to update the vector map. At this phase the vector data were converted to spatial database.

4.3. Analysis and preparing the spatial data

In this step, the design of a tourist map is based not only on the delimitation of a geographical area polygon, but also is relevant the positions and classifications of the tourism attractions. Added to this, it is necessary to use concepts and be based on techniques that identify and classify the various attributes of the location, in order to organize the information that will be communicated through the map.

First of all we ask: what actually would be a tourist attraction? What is its relevance to a map?

The tourist attraction is inserted in the set of operational actions mentioned by Beni (2003), precisely within the subsystem of the offer which the author defines as: The set of equipment, goods and services, accommodation, food, recreation and leisure, artistic character, cultural, social or other types, able to attract and settle in a given region over a specified period of time, a visiting public.

The tourist attractions are the travel motivator's agents and constitute the raw material of tourism. They inspire the displacement of visitor from its residence to the destination. The offer subsystem is more comprehensive and includes, besides the attractions, a whole range of goods and services that promote and support the tourism industry.

To develop the tourist map is essential the identification and distribution of this set of offer elements in the space. The consequence of this distribution is the formation of tourism space (Boullon, 2002), geographical place where the attractions are located, the tourism related developments and all supporting infrastructure. We agree with author when he noted that when technicians work in determining the tourist space, what they do is to define, on a map, an area of flat dimensions, which is the best way to represent the space that matters to physical planners. Although the concepts mentioned of physical space delimitation associated with cartography refers to the tourism planning, they also serve to conclusions about the tourist map perspective discussed here, the tourists' map.

In this context, taking into account the touristic space classification Boullon (2002), it is considered that Gravatá is a Tourist Distribution Center, because it is characterized by having attractions enough to motivate a trip, with average hosting periods of three days, in addition to having support facilities, such as hotels, and infrastructure like health services, banking and security located in the urban context, in which they are based. That is, tourists visit the attractions in its radius of influence, they enjoy feeding

equipment, souvenirs market, guide services etc, when visiting the attractions and stay in town overnight.

Based on these concepts, the tourist relevance elements of the city were identified and the next process is to preparing the plan of surveying terrain to collect them.

4.4. Planning Field Survey

The activities of field survey are a great means of this work, the students learned so much in this stage. All the points of the city's economic and utility importance were made through GPS survey (only C/A, accuracy of 15m), examples: banks agencies, drugs, hospitals, restaurants, police stations, gas stations, hotels, inns, restaurants, coffee shops, among others.

GPS receivers used were provided by Gravatá's City. These devices are low cost and low accuracy for cartographic researches, but considering that the low cost methodology conditioned it and the lack of resources and the maps base of the Municipality to complete this project, they became suitable for the job.





4.5. Data Classification and Design Map






















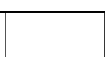
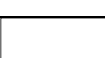

In this phase, the data was structured as a database, but using the Excel spreadsheet. In this structure was developed an average points attributes classification on the field taking as a base the Tourist Offer Classification regarded as the *Manual do Pesquisador do Projeto de Inventário da Oferta Turística do Ministério do Turismo* (Brazil, 2006). This Tourist Rating Project was conducted by the Federal Government and was aimed to generate systematic information by cataloging and diagnosing the attractions, tourist services and equipment and infrastructure of municipalities based on the guidelines of the National Tourism Plan.

Following the Touristic Offer Classification methodology, the points raised during the field work were categorized each one in one of the three Classes whose concepts were defined in the Researcher Manual as (Brasil, 2006, p. 10):

- **Tourism Support Infrastructure:** Set of actions, services and physical infrastructure, providing good living conditions for the community and provides a basis for tourism development: transportation systems, electrical service, water supply, street's conditions, communication system, educational system etc.
- **Turistic Services and Equipment:** Set of services, buildings and facilities necessary for the tourism development and that exists because of it. Including hospitality services and equipment, nurshiment, agency, event, leisure and entertainment transportation, etc.
- **Touristic Attractions:** Places, objects, equipment, people, phenomena, events or manifestations that motivate the people movement to meet them.

The classes were subdivided into categories, types, and, when necessary, subtypes according to *Table 1*:

Class	Category	Type	Sub type	Symbols
Tourism Support Infrastructure	Access and Localization	Access Point		
		Reference Point		
	Meios de Acesso ao Município	Terrestrial	Terminals/Stations Bus Stations/Bus Station Services	
	Other services and	Fueling Station	Gas Station	

	Support Equipment	Banking Agencies / Currency Exchange Offices	Bank	
		Commerce	Art Galleries / Antiques	
			Shopping Malls and Banks	
	Hospital Medical System	Hospitals	Hospitals	
		Health Center	Infirmaries	
		Pharmacies / Drug Stores	Drug Stores	
	Communication System	Postal Services	Post Office	
	Security System	Highway Police	PRF (Federal Highway Police)	
		Police Stations	Police Stations	
			Military Police	
Touristic Services and Equipment	Hospitality Services and Equipment	Hosting ways with registration needed	Hotel	
			Laser Hotel / Resort	
			Farm Hotel	
			Inns	
	Gastronomic Services and Equipments	Restaurants	Fondue	
			Regional Restaurant	
			Italian Restaurant	
			Steak Houses	
		Pubs / Coffee Shops / Dinners	Pub	
	Laser Entertainment Services and Equipments	Parks / Gardens/ Plazas	Plaza	
		Clubs	Club	
	Event Services and Equipments	Parks / Exposition Pavilions	Events Spaces	
	Transportation Services and Equipments	Taxis	Taxi	
	Other Touristic Services and Equipments	Touristic Information	Center for assistance	

Touristic Attractions	Cultural Attractions	Craftwork	Wood	
		Buildings	Religious Architecture	
			Civil Architecture	
		Fairs and Markets	Fairs	
			Craftwork Markets	
		Regional Gastronomy	Regional Goods / Sweets and Salty foods	
		Cultural Institutions	Museums / Memorials	
		Art Works	Sculpture / Statuaries / Monument / Obelisk	

Table 1. Field Research Points Classification

With the classification defined and information structured as database pattern, the data were transferred to ArcGIS, version 9.3. (GIS available in the laboratory of UFPE). With the use of ArcGis was possible to develop the City of Gravatá touristic map, using graphic semiology theory entirely as defined by Bertin (1983) and the one specified by Carpendale MST (2003).

The elements that characterize a cartographic project and that were relevant to the work appear in the composition of the attribute table with the shapefile file type, shown below:

- **Local:** Locality name where the geographic coordinates measuring was made.
- **LAT:** Point's Latitude on geographic coordinate(decimal degree).
- **LONG:** Point's Longitude on geographical coordinates (decimal degree).
- **LAT_UTM:** Point's Latitude on UTM (Universal Transversa de Mercator) coordinates.
- **LONG_UTM:** Point's Longitude on UTM (Universal Transversa de Mercator) coordinates.
- **Altitude:** Point's Altitude (ellipsoidal).
- **Classe:** Point's Class in accordance with the *Classificação da Oferta Turística do Manual do Pesquisador* (BRASIL, 2006).
- **Categoria:** Point's Category (Class subclassification).
- **Tipo:** Point's Type (Category's subclassification).
- **Subtipo:** Point's Subtype (Type's subclassification).
- **Ponto_GPS:** Points's Numbering generated by the GPS receiving device.
- **Precisão_m:** Precision ray, in meters, of the point in the moment of measurement.
- **Mod_Equip:** Equipment model utilized to measure the point.
- **Informações:** Complementary information about the locality.
- **Fonte:** Information's reference sources.

4.6. Development of the Touristic Mapping

To elaborate the tourist map, municipal boundary limits, hydrography and road maps are required whose files in the shapefile format were made available for free by IBGE. As the results reached so far, we have the map in format. MXD containing the following categories in shapefiles format:

- **Atrativos_Turísticos:** elements representing the locations where the Gravatá touristic attractions are;

- **Serviços_Equipamentos_Turismo:** elements representing the locations where there are equipments and Services providers that support tourism, such as hotels, restaurants, clubs, etc.;
- **Infraestrutura_Apoio_Turismo:** elements representing the locations that support tourists, such as boats, access and references' points, and even place that can supress security and health needs of the visitors like police fourse and hospitals;
- **Hidrografia_Gravata:** polylined graphical elements that represent the mais watercourses in the municipality. The Ipojuca river is represented with thicker lines;
- **Rodovias_Gravata:** elements that compose the main roads that run through the city. Graphically, these lines were differentiated into continuous lines - when dealing with paved roads, and dotted lines - when it comes to unpaved roads
- **Limite_Gravata:** Contour element which defines the political-administrative municipality of Gravatá.

The others activities like choice of graphic variables to be used to the map graphical print and web publishing; choice of scale printing, choice the visualization process and finally, test the graphic variables to impression version and display monitor are made using the laboratory.

One the example of this work can be show in Figure 1, in this case the shapes' elements were organized graphically with symbols and characters which were coded into map legend. The original map print was prepared for printing on a scale of 1:10,000, A3 size. The web map is published in arcgis online.



Figure 1. Urban Tourist Map generated (illustrated only)

5. Conclusion

The results of this research and course of graduation were a successful and more, all expectations and cartographic design execution with regard to the low cost methodology for developing a thematic map. In cartographic terms, survey field and spatial data processing contributed to the students' learning and development, as well

as work experience in their development all the cartographic project applied of the municipalities where don't have base maps. Students learned the operations of softwares like GIS (Geographic Information System) also, applying graphic variables and visualization of spatial data. The municipal public administration was satisfied with the accomplished results.

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